NOTES AND COMMENTS.

I

OUR STRUGGLE FOR EXISTENCE.

FROM time immemorial it has been the custom to regard disease as a necessary concomitant of life. Many reasons have been suggested for its existence, even to the hypothesis that disease is the normal state of man, and health but an exceptional or abnormal state. But, aside from theories of this sort, we have much new and positive knowledge respecting the nature of diseases. And while it may be premature as yet to speak of all diseases as belonging to one class, yet the number of them that may be placed under a single head is so great that the public should realize what an enormous addition to our knowledge has been made through biological research.

To put it popularly, what is called disease is no longer a mysterious entity, nor are its causes usually obscure. In great part it seems to be a struggle for existence between ourselves and certain lower forms of life. Were it not for these attacking hosts, it is not at all improbable that man could easily resist injuries (unless vital organs were mechanically crippled), changes of temperature, humidity, pressure, etc., and live a life of greatly increased duration, in which physical discomfort, except from accident, should be almost unknown.

What is the nature of these attacking hosts which constitute disease? We know that the seeds of many plants float about in the air, and that when they fall on suitable soil and are exposed to favorable conditions of moisture, temperature, light, etc., they germinate and grow at the expense of the air and the soil. The plant sends out its leaves and breathes the air, taking in such nutriment as its organism requires, while its roots pierce downwards in search of the nutriment that is in the soil. Every one who observes at all knows all this. He sees the floating seed of the dandelion, the whirligigs of the maple, and he wearily picks off the clinging burr which is trying to make him its carrier. He knows that rich soil, moisture, fresh air, and sunlight are necessary to luxuriant plant-life. He knows more. He knows that a solution of sugar, such as a fruit-juice, if exposed to the air, soon goes into fermentation and passes from a sweet liquid into one that is alcoholic and intoxicating. He also knows that this is no new phenomenon, for the patriarch Noah proved by the most convincing experience that it was a well-known fact even in his day.

The man of the present day who has had any kind of scientific education knows that this fermentation of sugar is caused by the growth in the sugar of a minute plant, called the yeast-plant, the spores, or seeds, of which are omnipresent in the atmosphere of the temperate and tropic zones. These little seeds fall into a sugar solution that is exposed to the air and grow with great energy. Sugar is the particular food of the yeast-plant, and the carbonic acid and alcohol which are formed from the sugar during its growth are the products of its life. If we sow a rich field with corn, we get an exuberant growth of the corn-plant. If we sow the seeds of yeast in a liquid containing sugar, we get a luxuriant growth of the yeast-plant. It is a good thing to make two blades of grass grow where one had struggled up before, and the change of the saccharine juice of fruit into wine is as well known to the careful housewife of to-day, who makes her blackberry wine to gladden the heart of her husband, as it was to St. Paul, who so emphatically indorsed the dietetic action of the yeast-plant's product.

So far the biologist and the public go easily together, but at this point the broad and well-beaten road ends, and a difficult path, beset with many obstacles, leads onward. On this the trained senses of the biologist carry him with ease through vast domains that are almost unknown to the unskilled man, and in which the latter soon loses himself, since he knows not the landmarks and has not a compass wherewith to guide his steps aright.

To speak again popularly,—for this is not the place to go into the minuter details of biological science,—there are certain microscopic seeds, or spores, that grow best in an albuminous soil, and the organisms resulting from them alter, decompose, or assimilate the albuminous matters in which they grow or on which they thrive. These seeds—I use the word in its broadest and most popular sense—are found widely disseminated in nature, some in the air, some in water, and others in the soil and in our food. So universally are these minute germs distributed that it is difficult to find any object which has been exposed to air or water that does not contain more or fewer of them. The liquids and organic solids of our bodies are largely composed of substances that afford these seeds their most suitable nutriment, and our bodily warmth makes the conditions necessary for their growth most favorable. Suppose one gets a deep wound. On this fresh, raw surface rain the myriads of germs floating in the air, or they are communicated by the fingers that touch the wound, or the garments that adhere to it. Among these multitudinous seeds are some that find the conditions of nutriment, moisture. and temperature most favorable to their development, and in a short time they reproduce, reaching numbers almost beyond the power of the imagination to grasp. In consequence of this the wound does not heal; it runs, becomes foul, blood-poisoning sets in, and the man dies. In other cases, the wound heals and the man recovers.

Let us examine this again in a popular way. When the freshly-exposed surface is attacked by the invading seeds, it does not rest quietly, as does the soil when the plant seed is placed in it, but countless minute organisms, which exist in and are produced by the human mechanism, attack the foreign germs and destroy them, and so prevent their growth and reproduction. Should this protecting army conquer, the invading host is destroyed and the wound heals. Should the invaders get the upper hand, then the protecting army is disorganized and overcome, and the flesh or organ, instead of remaining a part of a delicately-adjusted mechanism, becomes mere food for the foreign life. These foreign organisms do not, like the yeast-plant, eliminate carbonic acid and alcohol, but many of them produce terrible poisons, which, mixing with the blood, are carried to the vital centres, and so the man dies from poisoning as well as from a disabled organ.

Multitudes of these disease-germs exist. Some grow in raw flesh; some are breathed in with the air and take up their abode in the lungs, as, for instance, in the case of consumption; some show a preference for certain parts of the intestinal tract, as in typhoid fever and cholera. Others attack the liver, and others, again, thrive best in some of the glands and on the mucous membranes, as in the case of diphtheria. The rapidity of reproduction of these lower forms of life almost surpasses belief. The *bacterium termo* (fortunately not a disease-germ) is a minute rod, which reproduces itself by breaking in two. Each half then grows larger and again breaks in two. This process goes on very quickly. Indeed, if its reproduction were unrestricted, a single *bacterium termo* would in a short time fill a space as large as that occupied by the Atlantic Ocean.

Fortunately for us, while the disease-germs are numerous enough about us, we are provided with many means of resisting their onslaught. If, for example, they get into the blood, the white corpuscles of the blood attack and eat them up. But the balance is at best a delicate one, and it takes but little to turn it against us. There are many of these disease-germs, however, that are not easily resisted. If they find their way into our organism by inoculation, through a scratch or cut, for instance, they are invariably more or less successful in establishing a foothold within us, in which case we must succumb. We cannot be food for other organisms and at the same time live for ourselves.

In the laboratory of the biologist may be seen little phials in which are contained

the seeds of diseases. By the prick of a needle an animal may be inoculated with the specific disease that is named on the label of the phial, as with hydrophobia, diphtheria, or scarlet fever. This can be done with as much certainty as the farmer would sow the seeds of corn, rye, or wheat, knowing that he would get crops according to the sowing.

The majority of diseases, it now appears, are thus explicable. All the fevers and the contagious diseases, and many of the constitutional infections, are probably to be traced to the parasitic development which I have described. These diseases are results of a struggle for existence between man and minute forms of life. If these foreign organisms, the so-called saprophytes, gain a foothold, and the conditions continue favorable to their development, the man suffers or dies.

We are not considering the ethics of the subject. We shall not discuss which has the better right to survive, the saprophyte or the man. It is possible that in the vast scheme of the Cosmos, such a small portion of which we comprehend, good and sufficient reason may exist for the victory of the saprophyte. But from our standpoint we must regard our own existence as the more important. Man must consider as inimical to himself every object and every influence that tend to shorten, endanger, or injure his life, or impair his happiness. We are at war with myriads of lower organisms which are trying to live on us, and which by so doing injure, cripple, or kill us. Wars are children's games compared to these silent, invisible, deadly enemies which are ever about us, waiting for an unprotected spot on which to attack us. They have neither conscience nor feeling. They are the seeds of death. They respect neither sex, station, nor age. Their existence means misery, agony, and death to the human race. The issue is fairly before us. Let no man slight it or undervalue its magnitude. These enemies cannot be laughed or reasoned away. We cannot escape them. The most important question to-day is, How can we protect ourselves against the saprophyte?

PETER T. AUSTEN.

II.

RAPID TRANSIT IN CITIES.

THE PROBLEM of the rapid transportation of travellers within its own limits has not yet been satisfactorily solved by any of the large cities of Europe or America. As for travel upon regular lines of railway from city to city, probably very nearly the ultimate possibility of human accomplishment has been reached in the "Flying Scotchman," the "Flying Irishman," and the "Chicago Limited." At all events, it is difficult to see how much greater speed can be attained on rails of steel or iron within the reasonable limits of safety, even if we admit that electricity or some other substitute for steam (Mr. Keely's "motor," for instance) may be made available in the future. In intra-urban transit, however, much less marked progress has been made. The horse- or tram-car slowly displaced the omnibus or stage; and up to the present time this has been our chief reliance. Elevated and underground railways are scarcely more than a dozen years old, and their use thus far has been extremely limited. Such means of travel as are afforded by the underground railways of London and the elevated railroads of New York are as great an improvement upon the lumbering horse-car as an ordinary "way" train on our railroads is an advance upon the stage-coach of the olden time; and no greater. For travel in cities there has not yet been provided the correspondent of the railway "express" train. Until that is furnished, the problem stated in my opening sentence will not approach solution.

Ten years' experience has shown conclusively that the elevated-railway system of New York cannot furnish *rapid* transit. It has also shown beyond dispute that this is but a single step in the unfolding of the rapid-transit question. Already the elevated cars are as distressingly overcrowded as the horse-cars were twelve or fifteen years ago. Competent observers affirm that the underground roads of London have done no more for that city than the elevated roads have done for New York, even if they have done as much. Doubtless nine out of ten unprejudiced men who have travelled on both systems would unhesitatingly say that the elevated is preferable to the underground on account of light and ventilation, and at least its